

What is claimed is:

1. A composite carbon fiber material comprising:

a central layer formed of a plurality of carbon fibers aligned in a common direction and adhered to one another by an electrically conductive resin matrix;

a first nonwoven carbon fiber mat arranged on a first flat surface of the central layer;

a second nonwoven carbon fiber mat arranged on a second flat surface of the central layer;

a first layer of thermoplastic resin applied to an exterior surface of the first nonwoven carbon fiber mat so as to penetrate to the first flat surface of the central layer; and

a second layer of thermoplastic resin applied to an exterior surface of the second nonwoven carbon fiber mat so as to penetrate to the second flat surface of the central layer.

2. The composite carbon fiber material according to claim 1, wherein the first nonwoven carbon fiber mat and the second nonwoven carbon fiber mat are each selected to have a thickness in a range from 0.08 mm to 0.79 mm.

3. A composite carbon fiber material comprising:

a plurality of central layers each formed of a plurality of carbon fibers commonly aligned, wherein the plurality of carbon fibers are adhered to one another by an electrically conductive resin matrix, and wherein the plurality of layers are superimposed on each other and mutually

adhered by a thermoplastic resin;

    a first nonwoven carbon fiber mat arranged on a first external flat surface of the plurality of central layers;

    a second nonwoven carbon fiber mat arranged on a second external flat surface of the plurality of central layers;

    a first layer of thermoplastic resin applied to an external surface of the first nonwoven carbon fiber mat so as to penetrate therethrough to the first external flat surface of the plurality of central layers; and

    a second layer of thermoplastic resin applied to an external surface of the second nonwoven carbon fiber mat so as to penetrate therethrough to the second external flat surface of the plurality of central layers.

4. The composite carbon fiber material according to claim 3, wherein the first nonwoven carbon fiber mat and the second nonwoven carbon fiber mat are each selected to have thickness in a range from 0.08 mm to 0.79 mm.

5. The composite carbon fiber material according to claim 3, wherein the plurality of central layers comprises a first layer and a second layer, the first layer having the plurality of carbon fibers thereof arranged in a first direction and the second layer having the plurality of carbon fibers thereof arranged in a second direction substantially perpendicular to the first direction.

6. The composite carbon fiber material according to claim 3, wherein the plurality of central layers comprises a first layer and a second layer, and further comprising a third nonwoven carbon fiber mat juxtaposed and adhered between internal flat surfaces of the first central layer and the second central layer.

7. A method of making a composite carbon fiber material, comprising the steps of:  
forming a central layer of a plurality of carbon fibers aligned in a common direction and adhered to one another by an electrically conductive resin matrix;  
arranging a first nonwoven carbon fiber mat on a first flat surface of the central layer;  
arranging a second nonwoven carbon fiber mat on a second flat surface of the central layer;  
coating an exterior surface of the first nonwoven carbon fiber mat with a layer of a thermoplastic resin;  
causing the thermoplastic resin to penetrate through the first nonwoven carbon fiber mat to the first flat surface of the central layer;  
coating an exterior surface of the second nonwoven carbon fiber mat with a layer of the thermoplastic resin; and  
causing the thermoplastic resin to penetrate through the second nonwoven carbon fiber mat to the second flat surface of the central layer.

8. The method of making a composite carbon fiber material according to claim 7,

comprising the further step of:

selecting the first nonwoven carbon fiber mat and the second nonwoven carbon fiber mat to have a thickness in a range of 0.08 mm to 0.79 mm.

9. The method of making a composite carbon fiber material according to claim 7, wherein the step of forming a central layer comprises:

forming a first layer of a plurality of carbon fibers aligned in a first common direction and adhered to one another by an electrically conductive resin matrix;

forming a second layer of a plurality of carbon fibers aligned in a second direction and adhered to one another by an electrically conductive resin matrix, wherein the second direction is chosen to be substantially perpendicular to the first direction; and

adhering the first layer to the second layer with a thermoplastic resin.

10. The method of making a composite carbon fiber material according to claim 9 comprising the further step of arranging a third nonwoven carbon fiber mat between the first layer and the second layer before adhering the first layer to the second layer.